COMPARATIVE ANALYSIS THE PHYSIOLOGICAL VARIABLES OF ALL INDIA INTERVARSITY LEVEL BATSMEN'S, PACE BOWLERS, SPIN BOWLERS, WICKETKEEPERS AND ALL-ROUNDERS MEN CRICKETERS OF INDIA

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ABSTRACT

The purpose of the study was Comparative Analyse the Physiological Variables of All India Intervarsity Level Batsmen's, Pace Bowlers, Spin Bowlers, Wicketkeepers, and All-Rounders men cricketers of India. For the purpose of this study, one hundred and fourteen cricket players which consist 22 batsmen, 40 bowlers (i.e. 25 medium pace and 15 spin bowlers) 14 wicket keepers, and 38 all-rounders were selected. The following physiological variables were considered to be the major factors contributing to the performance in the cricket- Resting pulse rate, Resting blood pressure, Hb content, Vital capacity, Anaerobic power, and Aerobic capacity. To prepare profiles of All India Intervarsity Level cricket Men players of India, descriptive analysis i.e. mean and S.D. was done. For the comparison of the physiological variables analysis of variance (Anova) and test Schafee,s post hoc test was applied. The mean of Hemoglobin of batsmen's, pace bowlers, spin bowlers, wicketkeepers, and all-rounders were 13.79 mm/Hg, 13.32 mm/Hg, 13.16 mm/Hg, 13.13 mm/Hg., and 13.66 mm/Hg, Resting Pulse rate were 69.68 bt/min., 70.12 bt/min., 70 bt./min., 70.64 bt./min., and 70.34 bt./min., systolic blood pressure were 115.81, 116.28, 116.9, 116.64, and 117.2, diastolic blood pressure were 92.00, 93.24, 92.80, 89.21, and 92.97, the mean of Vital Capacity were 3.16 ltr, 3.1 ltr 2.99 Ltr, 2.52 ltr., and 2.95 ltr, Anaerobic Power were 724.57 Watt, 703.59 Watt, 706.2 watt, 704.93 Watt., 687.690 Watt, Aerobic Power were 35.13 Watt, 35.66 Watt, 35.88 Watt, 39.19 and 38.66 Watt. On comparatively analysis it was found that only Vital Capacity among All India Intervarsity level Cricket Batsmen's & wicketkeepers was significant and no other physiological variable were not found significantly different among Batsmen's, Pace Bowlers, Spin Bowlers, Wicketkeepers, and All-Rounders men cricketers of India at .05 level of significance.

Key Words: *Physiology, Anaerobic, Aerobic, Hemoglobin and VitalCapacity.*

INTRODUCTION:

Cricket is the most popular sport in commonwealth countries and one of the most popular sports in the world. The performance of cricketers is enhancing day by day, old records are broken and

new records are forming; scores are reaching new heights, it is due to high intensity training of the players which help them to perform well.

Today is the modern competitive cricket era. Every cricketer is in race to excel others, and cricket competitions have become fundamental mode of human expressions as they are one of the very important functions by which national and international recognition and prestige is gained. From its very simple form, cricket has emerged in to highly organized activity of Indian society and it has become a complex social and cultural phenomenon. Sports has permitted most of our social Institutions including education, Economics, Art, Politics, Law, Mass Communication and International Diplomacy.

Physiological system is highly adoptable to exercise. Each task has measure Physiological Components and fitness, for the task require, effective functioning of the appropriate system. Involvement in systematic programme of training brings about desirable changes in the Physical and Physiological factor, contributing to the development of functional abilities, which enhance the athlete's performance in sports.

Games of cricket, batting and bowling require a unique set of skills, and these are popular sports in several Western countries. Common exercises involved with cricket, batting and bowling include standing for long periods of time, bending, stooping and squatting. These exercises can burn a significant number of calories per hour and are a low to moderate-paced fitness activity.

Anthropometry, Physical Fitness, and Physiological profiles play an important role in performance in various Sports and Games. Some games may not be affected by physique, physiological Profile or Physical fitness but they may be much affected by psychological Status such as Chess. Every sport has its specific requirement to perform better in it. There are a number of examples when physique and physiological profile, make difference in performance for example Michael Phelps in Swimming, Michael Jordan in Basketball, Usain Bolt in Athletics and undoubtley Sunil Gavaskar and Sachin Tendulkar in Cricket batting skills, while Glen McGraw, Shoib Akhtar, Bret Lee, and Shane Bond play a vital role in Cricket Bowling.

Every sport requires a specific fitness or Physiological status, the game of badminton requires different physiological status than a long distance runner or a basketball player. Some games need different fitness for different places like in football and hockey, Physiological requirement

of player playing at different positions are different. And in some games like cricket every skill requires a different physiological status; the batsmen may have different physiological status than a pace bowler or wicketkeeper.

Noakes and Durandt Analyse the physiological requirement of cricket. The purpose of the study was to find out the Physiological requirement of Cricket. The Research Scholar propose that no current model used to analyse the nature of exercise fatigue (i.e. the cardiovascular-anaerobic model, the energy supply-energy depletion model, the muscle power-muscle recruitment model) can adequately explain the fatigue experienced during cricket. A study of players in the South African national cricket team competing in the 1999 Cricket World Cup revealed that, in a variety of measures of explosive ('anaerobic') power and aerobic endurance capacity, they were as 'fit' as South African national rugby players competing in the 1999 Rugby World Cup. Yet, outwardly, the physiological demands of rugby would seem to be far greater than those of cricket. This poses the question: 'Why are these international cricketers so fit if the physiological demands of cricket are apparently so mild?' One possibility is that this specific group of athletes are unusually proficient in a variety of sports; many achieved high standards of performance in other sports, including rugby, before choosing to specialize in cricket. Hence their apparently high fitness may simply reflect a superior genetic physical endowment, necessary to achieve success in modern international sports, including cricket. Alternatively, It was concluded that superior power and endurance fitness may be required to cope with the repeated eccentric muscle contractions required in turning and in bowling and which may account for fatigue and risk of injury in cricket, the fitness of cricketers may be increased and their risk of injury reduced by more specific eccentric exercise training programmes.

Christie, Todd, and King conduct a pilot study on selected physiological responses during batting in a simulated cricket work bout. The aim of this pilot study was to measure selected physiological responses during batting in a simulated high-scoring 1-day cricket game. Ten male university cricketers performed a batting specific work bout consisting of four sprints per over (six balls) for a seven over period. Testing was conducted outdoors with players wearing full batting gear. All experimentation was conducted under temperate environmental conditions. During the simulated work bout, a portable on-line metabolic system (the k_4b^2) was attached to

the subjects for the continuous assessment of selected physiological variables including heart rate (HR), ventilation (F_B, V_T and V_E), oxygen uptake (VO_2) and metabolic carbon dioxide (VCO_2) production. Energy expenditure was calculated from the oxygen consumption responses and substrate use was calculated from the (VO_2 / VCO_2 responses. The results demonstrate that although the first over carried a statistically ($p < 0.05$) lower energetic cost than the remaining six overs, most physiological responses stabilised thereafter. This excluded the heart rate responses which increased significantly ($p < 0.05$) during the first three overs after which marginal increases were observed with no statistical difference between the last four overs (heart rate ranged from 149 ± 19 bt min^{-1} in the fourth over to 155 ± 18 bt min^{-1} in the last over). There was a mean energy expenditure of 2536 kJ h^{-1} over the duration of the work bout.

Johnstone and Ford conducted a study to find out Physiologic profile of professional cricketers. This study aims to provide a physiologic profile of professional cricketers and note positional differences at the start of the 2007/08 competitive season. Fifteen participants (9 bowlers, 6 batsmen) aged 25.0 ± 5.0 years (mean ± SD) took part in this study. Participants (bowlers and batsmen) completed a series of field-based fitness assessments: body composition (sum of 7 skinfolds, 72.5 ± 16.5 and 65.5 ± 19.3 mm, respectively), flexibility (sit and reach 8.1 ± 10.3 and 6.0 ± 6.2 cm, respectively), predicted maximal oxygen uptake (multistage shuttle run, 54.1 ± 2.8 and 56.1 ± 4.5 ml-1·kg-1·min-1, respectively), upper- (medicine ball throw, 7.7 ± 0.6 and 7.0 ± 0.1 m, respectively) and lower-body strength (countermovement jump, 45.7 ± 5.8 and 43.9 ± 4.1 cm, respectively), speed (sprint 17.7 m, 2.76 ± 0.6 and 2.77 ± 0.1 s, respectively), and explosive power (repeated jump, 31.0 ± 2.0 and 34.1 ± 4.8 cm, respectively). The data provided the physical fitness profile for each player, which, compared with normative data, identified that this cohort of professional cricketers had some superior fitness parameters compared with the general population, and where applicable, were comparable with other professional athletes. In addition, after effect size calculations, the results showed that some physical fitness differences existed between playing positions. It was concluded that Cricket professionals possess a superior level of physical fitness and strength, and conditioning coaches should seek to progress these physical parameters and further identify position-specific physical requirements to progress the modern game.

Chin and others examined the Physiological profiles and sport specific fitness of Asian elite squash players. The purpose of this study was to evaluate the physiological profile and sports specific fitness of Hong Kong elite squash players. It was conducted before the selection of the Hong Kong national squash team for the 1992 Asian Squash Championship. Ten elite squash players were selected as subjects for the study. Maximum oxygen uptake was measured using a continuous treadmill running test. A sports specific field test was performed in a squash court. The following means (s.d.) were observed: height 172.6(4.3) cm; weight 67.7(6.9) kg; body fat 7.4(3.4)%; forced vital capacity (FVC) 5.13(0.26) litres; maximum oxygen uptake (VO2max) 61.7(3.4) ml.kg-1.min-1; anaerobic threshold (AT) 80.2(3.3)% of VO2max; alactic power index 15.5(1.8) W.kg-1; lactic work index 323.5(29.4) J.kg-1, peak isokinetic dominant knee extensor and flexor strengths 3.11(0.29) Nm.kg-1 and 1.87(0.18) Nm.kg-1. On the base of find results it was Concluded that the Hong Kong squash players have relatively high cardiorespiratory sports specific fitness and muscle strength which may be one of the key factors that contributed to the success of the Hong Kong team in the Asian Championship.

Gabbett and others examined the Applied physiology of rugby league. The purpose of the study was to examine the applied physiology of rugby league. Rugby league football is played in several countries worldwide. A rugby league team consists of 13 players (6 forwards and 7 backs), with matches played over two 40-minute halves separated by a 10-minute rest interval. Several studies have documented the physiological capacities of rugby league players and the physiological demands of competition, with the physiological capacities of players and the physiological demands of competition increasing as the playing level is increased. However, there is also evidence to suggest that the physiological capacities of players may deteriorate as the season progresses, with reductions in muscular power and maximal aerobic power and increases in skinfold thickness occurring towards the end of the rugby league season, when training loads are lowest and match loads and injury rates are at their highest. Player fatigue and playing intensity have been suggested to contribute to injuries in rugby league, with a recent study reporting a significant correlation (r=0.74) between match injury rates and playing intensity in semi-professional rugby league players. Studies have also reported a higher risk of

injury in players with low 10-m and 40-m speed, while players with a low maximal aerobic power had a greater risk of sustaining a contact injury. Furthermore, players who completed <18 weeks of training prior to sustaining their initial injury were at greater risk of sustaining a subsequent injury. These findings provide some explanation for the high incidence of fatigue-related injuries in rugby league players and highlight the importance of speed and endurance training to reduce the incidence of injury in rugby league players. It was concluded that to date, most, but not all, studies have investigated the movement patterns and physiological demands of rugby league competition, with little emphasis on how training activities simulate the competition environment. An understanding of the movement patterns and physiological demands of specific individual positions during training and competition would allow the development of strength and conditioning programmes to meet the specific requirements of these positions.

PURPOSE:

The purpose of the study was Comparative Analyse the Physiological Variables of All India Intervarsity Level Batsmen's, Pace Bowlers, Spin Bowlers, Wicketkeepers, and All-Rounders men cricketers of India.

PROCEDURE:

Selection of subjects:- For the purpose of the study One hundred and fourteen cricket players which consist 22 batsmen, 40 bowlers (i.e. 25 medium pace and 15 spin bowlers) 14 wicket keepers, and 38 all-rounders were selected. All the subjects had participated at All India Interzonal Intervarsity Cricket (Men) tournament held at Chatrapati Sahuji Maharaj University Kanpur, in Feb 2011. These players were from the best eight teams of the country which had qualified for All India Interzonal Intervarsity tournament for the session 2010-11.

The following physiological variables, which were considered to be the major factors contributing to the performance in the cricket were Resting pulse rate, Resting blood pressure, Hb content, Vital capacity, Anaerobic power, Aerobic capacity,

Resting pulse rate was measured by counting the pulse per minute, Blood pressure was measured by Sphygmomanometer, Hb value was measured by Haemometre pipette, haemometre tube and stir (sahil's acid Haematin method) , vital capacity was measured by Spirometer, Anaerobic power was measured Margaria Anaerobic Power Test, Aerobic power was measured by cooper, 12 min. run and walk test

The tests were selected keeping in mind the administrative feasibility, availability and suitability with regard to the subjects to be employed for this study. All the subjects were exposed to medical tests.

To prepare Physiological profiles of All India Intervarsity Level cricket Men players of India, descriptive analysis i.e. mean and S.D. was done.

TABLE 1
COMPARATIVELY ANALYSIS OF PHYSIOLOGICAL PROFILE OF ALL INDIA INTERVARSITY LEVEL CRICKET PLAYERS OF INDIA

Variable	Batsman (N=22)		Pace Bowler(N=25)		Spin Bowler (N=15)		Wicket Keeper (N=14)		All-Rounders (N=38)	
	Mean	S.D	Mean	S.D	Mean	S.D.	Mean	S.D.	Mean	S.D.
Hemoglobin	13.79	1.02	13.32	1.02	13.16	2.15	13.13	1.16	13.66	.92
Resting Pulse Rate	69.68	2.39	70.12	1.62	70.00	1.73	70.64	5.27	70.34	2.07
Resting B. P.										
Systolic	115.81	5.02	116.28	4.52	116.9	3.84	116.64	3.24	117.2	3.83
Diastolic	92	3.16	93.24	2.92	92.8	2.97	89.21	4.70	92.97	3.83
Vital Capacity	3.16	0.42	3.1	.63	2.99	0.63	2.52	0.46	2.96	.65
Anaerobic Power	724.57	86.75	703.59	107.98	706.2	88.50	704.93	84.46	687.60	77.78
Aerobic Power	35.13	5.89	35.66	4.97	35.88	4.83	39.19	3.48	38.66	4.27

It is evident from the above table that the mean of Hemoglobin of batsmen's, pace bowlers, spin bowlers, wicketkeepers, and all-rounders were 13.79 mm/Hg, 13.32 mm/Hg, 13.16 mm/Hg, 13.13 mm/Hg., and 13.66 mm/Hg, whenever maximum mean was of batsmen's i.e. 13.79 and minimum mean is of Wicketkeepers was 13.13. The mean of Resting Pulse rate of batsmen's,

pace bowlers, spin bowlers, wicketkeepers, and all-rounders were 69.68 bt/min., 70.12 bt/min., 70 bt./min., 70.64 bt./min., and 70.34 bt./min., the table also indicate that highest mean of Pulse rate was of wicketkeepers and lowest pulse rate was of batsmen's i.e. 70.64 and 69.68 respectively. The mean of systolic blood pressure of batsmen's, pace bowlers, spin bowlers, wicketkeepers, and all-rounders were 115.81, 116.28, 116.9, 116.64, and 117.2 with highest mean value 117.2 of All-Rounders and lowest mean value 115.81 of batsmen's respectively. The mean of diastolic blood pressure of batsmen's, pace bowlers, spin bowlers, wicketkeepers, and all-rounders were 92.00, 93.24, 92.80, 89.21, and 92.97 with highest mean value 93.24 of pace bowler's and lowest mean value 89.21 of wicketkeepers respectively. The mean of Vital Capacity of batsmen's, pace bowlers, spin bowlers, wicketkeepers, and all-rounders were 3.16 ltr, 3.1 ltr 2.99 Ltr, 2.52 ltr., and 2.95 ltr whenever maximum mean was of batsmen's i.e. 3.16 ltr. and minimum mean is of Wicketkeepers was 2.52 Ltr., mean of Anaerobic Power of batsmen's, pace bowlers, spin bowlers, wicketkeepers, and all-rounders were 724.57 Watt, 703.59 Watt, 706.2 watt, 704.93 Watt., 687.690 Watt, The table also indicate that highest mean of Pulse rate was of Batsmen's and lowest pulse rate was of All-Rounders i.e. 724.57 watt and 687.60 Watt respectively. The mean of aerobic Power of batsmen's, pace bowlers, spin bowlers, wicketkeepers, and all-rounders were 35.13 Watt, 35.66 Watt, 35.88 Watt, 39.19 and 38.66 Watt, with highest mean value 39.19 of Wicket Keepers and lowest mean value 35.13 of Bowlers respectively.

The graphical representation of combined mean of Physiological Variables of All India Intervarsity Level cricketers' batsmen's, pace bowlers, spin bowlers, wicketkeepers, and all-rounders of India is presented in figure 1.

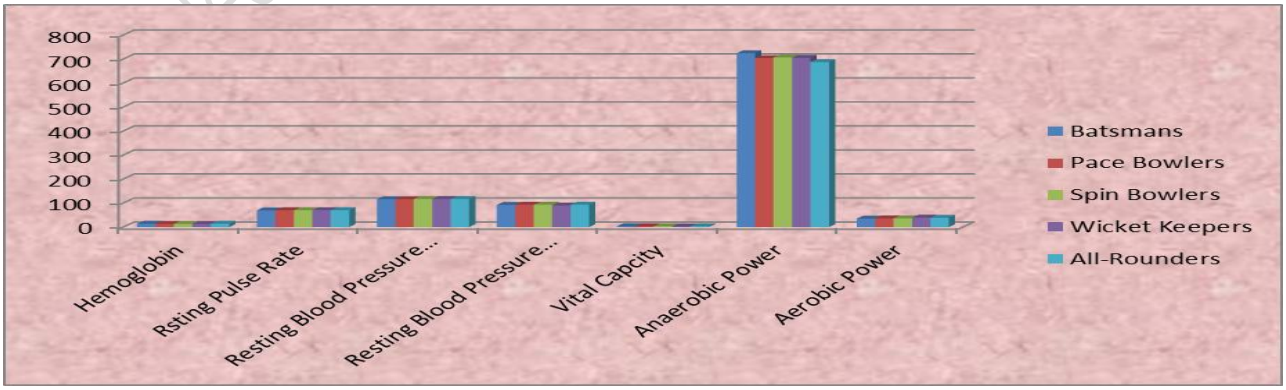

Fig. 1:- Graphical representation of combined mean of Physiological Variables of All India Intervarsity Level cricketers batsmen's, pace bowlers, spin bowlers, wicketkeepers, and all-rounders

For Comparative Analyse, the analysis of Variance (ANOVA) of the Physiological Variables of All India Intervarsity Level Batsmen's, Pace Bowlers, Spin Bowlers, Wicketkeepers, and All-Rounders men cricketers of India is presented in table 2.

TABLE 2
ANALYSIS OF VARIANCE FOR PHYSIOLOGICAL VARIABLES OF ALL INDIA INTERVARSITY LEVEL CRICKET BATSMEN'S, PACE BOWLERS, SPIN BOWLERS, WICKETKEEPERS, AND ALL-ROUNDERS MEN PLAYERS OF INDIA

Variable	Source of Variable	Sum of Squares	df	Mean Square	F Value
Hemoglobin	Between Groups	10.77	4	2.69	1.16
	Within Groups	251.11	109	2.30	
	Total	261.89	113		
Resting Pulse Rate	Between Groups	11.40	4	2.85	0.41
	Within Groups	756.08	109	6.93	
	Total	767.49	113		
Systolic Blood Pressure	Between Groups	53.29	4	13.32	0.82
	Within Groups	1758.43	109	16.13	
	Total	1811.72	113		
Diastolic Blood Pressure	Between Groups	175.42	4	43.85	1.02
	Within Groups	1372.31	109	42.59	
	Total	1547.74	113		
Vital Capacity	Between Groups	4.42	4	1.106	3.20*
	Within Groups	37,64	109	0.345	
	Total	42.07	113		
Anaerobic	Between Groups	20164.46	4	5041.12	0.71

Power	Within Groups	779730.08	109	7153.49	
	Total	779894.55	113		
	Between Groups	301.57	4	75.39	
Aerobic Power	Within Groups	2470,18	109	22.66	3.02
	Total	2771.76	113		

*significant at 0.05 level of confidence $F_{0.05}$ (4, 109) =3.07

The table clearly reveals that there is no significance difference in Hemoglobin, resting pulse rate, systolic blood pressure, diastolic blood pressure, Anaerobic Power, and Anaerobic Power among All India Intervarsity level cricket batsmen's, pace bowlers, spin bowlers, wicketkeepers, and All-Rounders men players of India as the calculated value of 'F' of Hemoglobin, resting pulse rate, systolic blood pressure, diastolic blood pressure, Anaerobic Power, and Anaerobic Power among are 1.16, 0.41, 0.82, 1.02, .071, and 3.02, which are significantly lower than the tabulated value of 'F' i.e. 3.07 at .05 level of confidence and with 109 degrees of freedom. And it is also clear from the table that there is significance difference in vital capacity among All India Intervarsity level cricket batsmen's, pace bowlers, spin bowlers, wicketkeepers, and All-Rounders men players of India as the calculated value of 'F' is 3.20, which is significantly greater than the tabulated value of 'F' i.e. 3.07 at .05 level of confidence and with 109 degrees of freedom.

The Critical difference for vital capacity among All India Intervarsity level Cricket Batsmen's, Pace Bowlers, Spin bowlers, and Wicketkeeper Men Players of India is presented in table 7.

TABLE 3

MEAN COMPARISON OF VITAL CAPACITY OF ALL INDIA INTERVARSITY LEVEL CRICKET MEN PLAYERS OF INDIA

Batsman	Pace Bowler	Spin Bowlers	All Rounders	Wicket Keeper	M.D.	C.D.
3.17	3.10	-------	-------	-------	0.07	0.54
3.17	-------	2.83	-------	-------	0.34	0.61
3.17	-------	-------	2.96	-------	0.21	0.49
3.17	-------	-------	-------	2.52	0.65*	0.63
-------	3.10	2.83	-------	-------	0.27	0.60
-------	3.10	-------	2.96	-------	0.14	0.47
-------	3.10	-------	-------	2.52	0.58	0.61
-------	-------	2.83	2.96	-------	0.13	0.56
-------	-------	2.83	------	2.52	0.31	0.69
-------	-------	-------	2.96	2.52	0.44	0.58

*****Significant at 0.05 level of confidence

The table clearly reveals that the mean comparison of Schefee's Post hoc of Vital Capacity among All India Intervarsity level Cricket Batsmen's & wicketkeepers was significant as respective mean 0.65, was higher than critical difference i.e. 0.63, however Post hoc test mean comparison of Vital Capacity among All India Intervarsity level Cricket Batsmen's & Pace Bowlers, batsmen & Spin bowlers, batsman & All-Rounders, pace bowlers & spinners, pace bowlers & All-Rounders, Pace bowler's & Wicketkeepers, spin bowler's and All-Rounder's, Spin bowler's & Wicketkeepers and All-Rounders and Wicket Keepers Men Players of India were not significant as respective mean 0.07, 0.34, 0.21, 0.27, 0.14, 0.58, 0.13, 0.31, and 0.44 were lower than critical difference i.e. 0.54, 0.61, 0.49, 0.60, 0.47, 0.61, 0.56, 0.69, and 0.58 respectively.

CONCLUSIONS:

1. It was concluded that the mean of Hemoglobin of batsmen's, pace bowlers, spin bowlers, wicketkeepers, and all-rounders were 13.79 mm/Hg, 13.32 mm/Hg, 13.16 mm/Hg, 13.13 mm/Hg., and 13.66 mm/Hg,.
2. It was concluded that the mean of Resting Pulse rate of batsmen's, pace bowlers, spin bowlers, wicketkeepers, and all-rounders were 69.68 bt/min., 70.12 bt/min., 70 bt./min., 70.64 bt./min., and 70.34 bt./min.
3. It was also concluded that the mean of systolic blood pressure and diastolic blood pressure of batsmen's, pace bowlers, spin bowlers, wicketkeepers, and all-rounders were 115.81, 116.28, 116.9, 116.64, and 117.2 and 92.00, 93.24, 92.80, 89.21, and 92.97 respectively.
4. The mean of Vital Capacity were 3.16 ltr, 3.1 ltr 2.99 Ltr, 2.52 ltr., and 2.95 ltr whenever maximum mean was of batsmen's i.e. 3.16 ltr.
5. It was concluded that mean of Anaerobic Power were 724.57 Watt, 703.59 Watt, 706.2 watt, 704.93 Watt., 687.690 Watt. And the mean of aerobic Power were 35.13 Watt, 35.66 Watt, 35.88 Watt, 39.19 and 38.66 Watt,.
6. It was also concluded that there was a significant difference in Vital capacity of batsmen's, pace bowlers, spin bowlers, wicketkeepers, and all-rounders.
7. It was also concluded that there were no significant differences were found that there wes no significance difference in other physiological variables of batsmen's, pace bowlers, spin bowlers, wicketkeepers, and all-rounders

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